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Science textbook based on Socio-Scientific Issues (SSI) for environmental pollution to increase student science literacy in junior high school

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Abstract. 21st century learning leads to problem solving, social emotional skills to face the challenges of RI 4.0 and it will have an influence scientific understanding. This scientific understanding is still low in analyzing and applying the concept of a problem that has an impact on the ability of science literacy. Science literacy is related ability to think scientifically by using knowledge and identifying natural phenomena. The results of the distribution of questionnaires for 18 junior high schools in Jember middle region of 89% stated the concept of science literacy of students was still lacking. Science literacy has a close relationship with Socio-Scientific Issues (SSI) which are described as social problems with a scientific context that connects students with scientific issues that are developing in society to be explored such as environmental pollution problems. This research used quasi-pretest-posttest experiment without control class. Data analysis using the mixed-method, and were analyzed quantitatively. The sample used was 33 students junior high school in VII C class room. The result obtained from pretest and posttest with open questions following aspect of science literacy and showed that students experienced an increase in science literacy by 0,75 in the high categories.

1. Introduction

The learning of the 21st century has put the industrial world ahead with the rapid development of scientific and technological progress to meet human needs. This century learning leads to critical thinking, problem solving, social emotional skills to face the challenges of the industrial revolution 4.0 [1 & 2]. These developments give problems in the form of global problems, environmental pollution, energy crises. This is due to lack of understanding of science [3]. The learning process of science tends to memorize and is less skilled in using knowledge so it does not hone the skills and potential of thinking [4 & 5]. This can be seen from the low ability of students to analyze and apply the concept of the problem, so that it impacts on the ability of science literacy [6].

Science literacy is related to the ability to think scientifically by using knowledge and identifying natural phenomena [7]. Science literacy is one of the skills needed in 21st century learning among the 16 skills identified by the World Economic Forum [8]. Scientific literacy also has a positive relationship with the ability to think critically and collaboratively which is one of the 21st century skills [9 & 10].

Socio-Scientific Issues (SSI) is described as a social problem with a scientific context that connects students with scientific problems that develop in the community to be explored [11]. This social scientific problem will make students gain experience about what they are learning so that learning becomes more meaningful [12].



Social-Scientific Issues (SSI) are closely related to social scientific problems such as cloning, biotechnology, global warming, climate change, environmental pollution, alternative energy sources, genetically modified foods [13 & 14]. Environmental pollution and insensitivity to the environment are the main problems time now [15].

Therefore, the integration of Socio-Scientific Issues (SSI) in this textbook will train students to explore themselves and find solutions to problems that develop in the community so that the science literacy ability is increasingly honed.

2. Methods

This study is a one-group experiment, which is one-group pretest and posttest design. The sample of this study was 33 students of class VII. Students in one sample class were given a pretest about environmental pollution to measure students initial level of understanding. After that, students are guided by the teacher to study environmental pollution from science textbook a based Socio-Scientific Issues.

Finally, students are given a posttest to measure their abilities after learning from science textbook based Socio-Scientific Issues (SSI). The pretest and posttest instruments consist of 6 open contextual questions that are relevant to the Socio-Scientific Issues (SSI), so that they can measure students science literacy. Open questions are in accordance with aspects of competence in science literacy measured, and those were namely explaining phenomena scientifically, evaluating and designing scientific experiments, and interpreting data and facts scientifically, with following indicators :

Table 1. The science literacy aspects.

Science literacy aspects	Indicators
Namely explaining phenomena scientifically	<ul style="list-style-type: none"> a. Remembering, identifying and applying appropriate scientific knowledge. b. Explain the potential implications of scientific knowledge for society.
Evaluating and designing scientific experiments	<ul style="list-style-type: none"> a. Identify questions that are investigated in certain scientific studies. b. Evaluate ways to investigate certain questions scientifically
Interpernting data and facts scientifically	<ul style="list-style-type: none"> a. Turn data from one form into another (diagrams, graphs, etc) b. Analyze, interpret and evaluate scientific data to draw appropriate conclusions

Source : Facione, 2016 [16]

The data collection techniques in this study used the test method. Analysis of the data obtained from this study is qualitative and quantitative. Qualitative data were generated in the form of descriptions of students science literacy abilities. The quantitative data of students science literacy ability has the following score criteria.

Table 2. The science literacy criteria.

Score	Science literacy criteria
$(g) > 0,7$	Hihg
$0,3 \leq (g) \leq 0,7$	Fair
$(g) < 0,3$	Low

Source : Facione, 1999 [17]

3. Results and Discussion

3.1. Science Textbook Based on Socio-Scientific Issues (SSI)

Science textbook based on Socio-Scientific Issues (SSI) is one of the science textbooks in which it provides an understanding of environmental pollution material through the approach of scientific issues or scientific issues that are developing in society to explored students through the process of discussion, debate, and problem solving with the help of teacher guidance so students can analyze and apply the concept of a problem that will have an impact on their scientific literacy abilities.

The ability of science literacy requires students to have a high sense of concern for themselves and the environment in addressing problems in the lives around them with the scientific knowledge they have [18]. Science literacy is the most important element in modern education projects.

The science textbooks will be systematically packaged by presenting several questions from scientific issues in the form of discourse obtained from various sources such as electronic media or news, newspapers and others that are accurate or valid and reliable. It is hoped that the higher the education level pursued, students will have a good capacity related to their science literacy abilities because science literacy is very important in modern education today.

The science textbook based on Socio-Scientific Issues (SSI) consists of several sections including the front page of the book, preface, table of contents, learning objectives, material diagrams, additional features, summaries, practice exercises, bibliography. So that the use of science textbooks based on Socio-Scientific Issues (SSI) will make students gain experience of what they learn so that learning is more meaningful.

3.2 Students Scientific Literacy Capabilities

Quantitative data of students scientific literacy abilities were obtained from pretest and posttest scores. Pretest and posttest consist of questions contextual that are in accordance with aspect of science literacy and problems socio scientific that are developing in society. The percentage of scores calculate the pretest and posttest scores using N-gain is presented in the following graph:

Table 3. The score science literacy aspect criteria.

Science literacy criteria	Percentage score science literacy
High	66,67%
Fair	33,37%
Low	0%

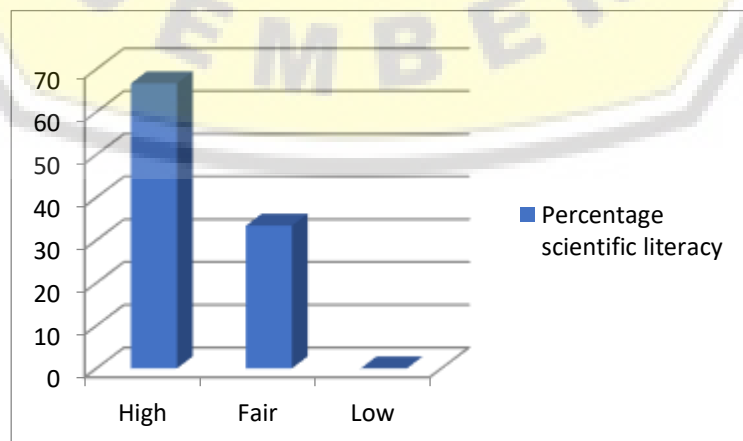


Figure 1. Students scientific literacy.

This data shows that the pretest and posttest values measured using N-gain science literacy ability of some students are in the criteria of high (66,67%), moderate (33,37%) and low (0%). The average N-gain is also obtained a value of 0,75 included in the high category. Based on these results it can be concluded that science textbooks based on SSI can increase students abilities in analyzing environmental problems that are currently developing in society so that students science literacy can improve.

4. Conclusions

This research can be concluded that the students science literacy ability is high category and none is in the low category. Science literacy skills increased it show that students already have a better ability to analyze and apply the concept of a problem that develops in society. This mastery of science literacy skills can support the development and use of 21st century competencies and put students attitudes, awareness, and sensitivity towards the environment. For future research, we suggest analyzing students scientific argumentation skills using science textbooks based Socio-Scientific on Issues (SSI) to environmental pollution.

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References

- [1] Zain 2017 The Collaborative Instructional Design System (CIDS): Visualizing the 21st Century Learning *Universal J. Educational Researchs.* **5** 2259-2266
- [2] Bayoci S B and Atalay N 2016 A Scale Development for 21st Century Skills of Primary School Students: A Validity and Reliability Study *International J. of Instruction.* **9** 133-148
- [3] Fananta 2017 *National Literacy Movement* (Jakarta: Ministry of Education and Culture)
- [4] Nofiana N and Juliyanto T 2017 Profile of Students' Literacy Capabilities Middle Schools in Purwokerto City Judging from the Aspects of Content, Process, and Science Context *J. Social Sciences and Humanities.* **1** 77-84
- [5] Rostikawati and Permaisari 2016 Reconstruction of Teaching Materials in the Context of Socio Scientific Issues in Food Additive Substances to Increase Scientific Literacy Scientific Issues in Substance Additives for Enhancing Student Literacy *J. Science Education Innovation.* **11** 156-164
- [6] Kurnia F Z and Fathurrohman A 2014 Analysis of Class XI High School Physics Textbooks in North Indralaya District Based on the Literacy Science Category *J.Innovation.* **1** 43-47
- [7] Demir E 2016 Characteristics of 15-Year-Old Students Predicting Scientific Literacy Skills in Turkey *International Education Studies.* **9** 99-107
- [8] World Economic Forum 2015 *New Vision for Education Unlocking the Potential of Technology* (Boston: British Columbia Teachers Federation) p 32
- [9] Rahayuni G 2016 Relationship of Critical Thinking Skills and Science Literacy In Integrated Science Learning with PBM and STM Models *J. Natural Sciences Research and Learning.* **2** 131-146
- [10] Yuliati Y 2017 Science Literacy in Science Learning *J. Horizon Pendas.* **3** 21-28

- [11] Sadler 2017 Evolution of a Model for Socio-Scientific Issue Teaching and Learning *International J. Education in Mathematics, Science and Technology*. **5** 75-87
- [12] Talens J 2016 Teaching with Socio-Scientific Issues in Physical Science: Teacher and Students' Experiences. *International J. Evaluation and Research in Education*. **5** 271-283
- [13] Zo'bi 2016 The Effect of Using Socio-Scientific Issues Approach in Teaching Environmental Issues on Improving the Students' Ability of Making Appropriate Decisions Towards These Issues. *International Education Studies*. **7** 113-123
- [14] Bilican K 2018 Analysis of pre-service science teachers' understanding of the nature of science and propose arguments on socio-scientific issues. *International J. Research in Education and Science*. **4** 420-435
- [15] Ahmehdovo A H 2016 How does air pollution threaten basic human rights? The case study of Bulgaria *J. Environment and Health (JESEH)*. **2** 160-165
- [16] OECD 2016 *PISA 2015 Assessment and Analytical Framework: Science, Reading, athematic and Financial Literacy* (Paris: OECD)
- [17] Hake, R, R. 1999. *Analyzing Change/Gain Score* (America: AREA-D American Education Research Association's Devision.D, Measurement and Reasearch Methodology)
- [18] Wulandari N and Sholihin H 2016 Analysis of Science Literacy Abilities in Knowledge Aspects and Science Competence of Middle School Students in Material Heat *Edusains*. **8** 68-73